Appl. No.: 10/707,927
Amdt. Dated: 4/25/2006
Reply to Office action of: 02/21/2006

AMENDMENTS TO THE DRAWINGS:

There are no amendments to the drawings presented herewith.

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REMARKS/ARGUMENTS

In the specification, the title has been amended to provide for a more descriptive title.

Claims 1 – 6 remain in this application. Claims 1 and 3 – 5 have been amended to overcome the Examiner's objections and rejections under 35 U.S.C. 112 and to correct minor editorial problems. Support for these amendments may be found in the original specification and drawings.

No new matter has been introduced by these amendments.

The Examiner has objected to the title as not being descriptive. By this amendment a suitably descriptive title based upon the Examiner's suggestion has been provided. The new title clearly overcomes the Examiner's objection.

Claims 1 – 6 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner states:

> The scope of the claimed invention directed to the multiple-milling method for making a printed circuit board; however, there is no positive method step for making the circuit board. Further, the claims 1 – 6 are being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP §2172.01. The omitted steps are: undercutting the printed circuit board and bending the cutting circuit board, etc., "said conductive layer" (claims 3 – 5, line 3) lacks antecedent basis.

Applicant respectfully traverses this rejection. The present claimsascurrently amended provide the positive steps the Examiner believes to be missing as well as providing the necessary antecedent basis in claims 3 – 5, line 3. Clearly, when viewed in this light this rejection is now moot and Applicant respectfully requests this rejection be removed.

Claims 1 and 1 – 5 were rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,925,298 to Walles et al. However, Applicant believes from the body of the rejection that the Examiner intended to say "Claims 1 and 3 – 5" therefore the

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Applicant's response is directed to the rejection being applied to Claims 1 and 3 – 5. Specifically, the Examiner states:

> Regarding claim 1, Walles et al discloses a multiple-undercutting milling process for manufacturing printed circuits board comprising a substrate and a metallic material conductive printed circuits adhere thereto, allowing subsequent bending of the printed circuit up to 180°into a U-shaped without deteriorating the printed circuits adhered to the printed circuits board substrate (see Fig. 6); said substrate having two opposite surfaces, a first surface for adhering the conductive metallic material and a second surface suitable for milling, comprising; preparing a substrate of printed circuit boards (10) with bending areas (18) allowing bending such printed circuits board consisting essentially of simultaneously undercutting multiple parallel strips (26 or 28, See Figs. 2A-B) on the second surface of the printed circuits substrate by means of a milling tool (See Col. 2, lines 37 – 38).
>
> Claims 3 – 5, Walles et al the conductive layer such as copper (see, Col. 2, line 26 – 27) having a thickness in ranges between 65 – 400 microns (See Fig. 1 and the discussion at Col. 2, lines 53 – 54). Note that the thickness of bending area or region being below 25 mils with 5 layers having equal thickness.

Applicant respectfully traverses this rejection. The key to Applicants' invention is the method of under-cutting of multiple parallel tracks in one surface of a circuit board substrate in a single operation. This allows for more time and cost effective production of circuit boards adaptable to bending or folding into up to a U-shape without damaging the electrically conductive tracked adhered to said circuit boards.

A fair reading of Walles et al. reference discloses a process for under-cutting a circuit board substrate and subsequently bending said circuit board by using a single under-cut or a series of parallel under-cuts produced one at a time by a single-point cutting device such as a carbide endmill or a fly cutter tool (see for example Col. 2, lines 36 – 38). Contrary to the Examiner's argument above, this reference specifically teaches the use of a single single-point cutting tool, specifically, "A groove 16 is cut into circuit board 10 to form a bend region 18. Groove 16 is preferably machined conventionally by using a carbide endmill, fly cutter, or similar tool." Clearly, the reference specifically

teaches one groove 16 or each of multiple grooves 16 being cut independently using a single-point cutting tool and specifically referred to in the singular. Clearly, the Walles et al. reference does not disclose, teach, or suggest the use of a single multiple-point cutting tool of Applicant's claimed invention. And equally clearly, the Walles et al. reference does not provide the necessary impetus for one skilled in the art to modify this teaching to utilize simultaneous multiple grooves being cut in a single operation as claimed in Applicant's invention.

The fact that the reference discloses the use of commonly known copper as the conductive material does not overcome the failing of the Walles et al. reference to teach the cutting of multiple parallel grooves simultaneously with a single tool. Contrary to the Examiner's assertion, the reference at Col. 2, lines 53 – 54 and Figures 2A and 2B do not address themselves to the conductive track thickness at all. Instead these references are directed specifically to the thickness of the circuit board substrate in the under-cut regions. Clearly, the Walles et al. reference does not disclose, teach, suggest, or provide the necessary impetus to use the single multiple-point cutting tool of Applicant's claimed invention for cutting a bending region on a circuit board having electrically conductive tracks of copper metal having a thickness of from about 65 to about 400 microns.

Claim 2 was rejected under 35 U.S.C. 103(a) as being unpatentable over Walles et al. in view of US Patent 5,726,495 to Aihara et al. Specifically, the Examiner states:

> Walles et al do not teach the milling tool of claim 2. Aihara et al teach a milling tool (21) comprises a roll having with multiple polishing strips o its surface (see Fig. 3) for forming a plurality of grooves on the surface of a component. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the milling machine of Walles et at by utilizing the milling tool taught by Aihara et al for a plurality of grooves on the surface of the printed circuit.

Applicant respectfully traverses this rejection. The key to Applicants' invention, as discussed above, is the method of under-cutting of multiple parallel tracks in one surface of a circuit board substrate in a single operation. This allows for more time and cost effective production of circuit boards adaptable to bending or folding into up to a U-shape without damaging the electrically conductive tracked adhered to said circuit boards.

A fair reading of Walles et al. reference discloses a process for under-cutting a circuit board substrate and subsequently bending said circuit board by using a single under-cut or a series of parallel under-cuts produced one at a time by a single-point cutting device such as a carbide endmill or a fly cutter tool (see for example Col. 2, lines 36 – 38). Contrary to the Examiner's argument above, this reference specifically teaches the use of a single single-point cutting tool, specifically, "A groove 16 is cut into circuit board 10 to form a bend region 18. Groove 16 is preferably machined conventionally by using a carbide endmill, fly cutter, or similar tool." Clearly, the reference specifically teaches one groove 16 or each of multiple grooves 16 being cut independently using a single-point cutting tool and specifically referred to in the singular. Clearly, the Walles et al. reference does not disclose, teach, or suggest the use of a single multiple-point cutting tool of Applicant's claimed invention. And equally clearly, the Walles et al. reference does not provide the necessary impetus for one skilled in the art to modify this teaching to utilize simultaneous multiple grooves being cut in a single operation as claimed in Applicant's invention.

A fair reading of the Aihara et al reference discloses a method of producing a heat sink having a bottom plate and a plurality of plane parallel plates or pins that are integral to said bottom plate produced using a plurality of individual cutting heads mounted on a common shaft used to cut multiple grooves in one direction in one pass and in a second perpendicular direction to said first direction in a second pass. In addition, the Aihara et al reference fails to disclose, teach, or suggest that this two pass cutting operation can be used to allow for circuit board substrates to be bent into a U-shape. And the use of multiple cutting tools mounted on a single shaft is not a single cutting tool having multiple cutting surfaces. Thus the Aihara et al. reference fails to provide the necessary impetus needed for one skilled in the art to combine it with the Walles et al. reference in any manner. Clearly, the only way that one skilled in the art would have the necessary impetus to combine the Walles et al. reference and the Aihara et al. reference is to have first read Applicant's claimed invention.

Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over Walles et al in view of US Patent 5,697,282 to Schakel et al. Specifically, the Examiner states:

> Walles et al do not teach the milling tool of claim 6. Schakel et al teach a milling tool (22) comprises a roll (52) having with multiple polishing teeth (62) on its surface (see

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> Fig. 3) for forming a plurality of uniform grooves on the surface of a substrate. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the milling machine of Walles et at by utilizing the milling tool taught by Schakel et al for a plurality of uniform grooves on the surface of the printed circuit.

Applicant respectfully traverses this rejection. The key to Applicants' invention, as discussed above, is the method of under-cutting of multiple parallel tracks in one surface of a circuit board substrate in a single operation. This allows for more time and cost effective production of circuit boards adaptable to bending or folding into up to a U-shape without damaging the electrically conductive tracked adhered to said circuit boards.

A fair reading of the Walles et al. reference, as discussed above, discloses a process for under-cutting a circuit board substrate and subsequently bending said circuit board by using a single under-cut or a series of parallel under-cuts produced one at a time by a single-point cutting device such as a carbide endmill or a fly cutter tool (see for example Col. 2, lines 36 – 38). Contrary to the Examiner's argument above, this reference specifically teaches the use of a single single-point cutting tool, specifically, "A groove 16 is cut into circuit board 10 to form a bend region 18. Groove 16 is preferably machined conventionally by using a carbide endmill, fly cutter, or similar tool." Clearly, the reference specifically teaches one groove 16 or each of multiple grooves 16 being cut independently using a single-point cutting tool and specifically referred to in the singular. Clearly, the Walles et al. reference does not disclose, teach, or suggest the use of a single multiple-point cutting tool of Applicant's claimed invention. And equally clearly, the Walles et al. reference does not provide the necessary impetus for one skilled in the art to modify this teaching to utilize simultaneous multiple grooves being cut in a single operation as claimed in Applicant's invention.

A fair reading of the Schakel et al reference discloses a method for cutting a series of parallel slots in large diameter duct liner using a plurality of saw blades mounted on a common shaft and using said parallel slots for allowing for said duct liner to be bent into a circle and inserted within a metallic duct. The Schakel et al. reference does not disclose how to provide a single milling tool head with multiple cutting areas, in fact, it does not teach milling tools at all but instead the use of multiple saw blades mounted on a

common shaft. Furthermore, the Schakel et al. reference does not disclose how to provide for bending a circuit board into a U-shape without damaging the printed circuit adhered thereon. The Schakel et al. reference clearly lacks the necessary impetus to one skilled in the art to combine this reference with the Walles et al. reference without first having knowledge of Applicant's claimed invention.

Clearly, none of these references are combinable as none of them provide the necessary impetus within their four corners to suggest to one skilled in the art to combine them or to modify them to make them combinable without first having knowledge of Applicant's claimed invention.

In view of the remarks herein, and the amendments hereto, it is submitted that this application is in condition for allowance, and such action and issuance of a timely Notice of Allowance is respectfully solicited.

Respectfully submitted,

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